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VALUE SAVINGS FROM ALTERNATIVE FELLING PATTERNS ON STEEP COUNTRY

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INTRODUCTION

The method of felling trees can affect the resulting value recovery of the timber. A recent LIRA report* described a FRI trial in Whaka State Forest with the objective "to examine products and value outputs, and costs of alternative felling patterns on second crop radiata pine on steep country". That report dealt with felling methods, felling times, stump heights, butt damage, and breakage and its causes in a 41 year-old pruned and thinned stand. This report is a sequel to the first report, and describes the value outputs from the various felling patterns and some of the factors which affected these.

TREE ASSESSMENT

Prior to felling, each tree was fully assessed using the MARVL technique**. The pre-felling value of each standing tree was estimated for two market conditions, domestic and export, with the assumptions that breakage and stump height were zero. (ref. Table 1).

The assumed "export" market had a wider value gradient with two additional log types and more rigid length specifications than the "domestic" market.

The log types and volumes for each tree, as printed in the MARVL output, were value-rated to derive estimated standing tree values.

TABLE I - ASSUMED MARKET CONDITIONS

Log Type	Min. Length (m)	Max. Length (m)	Min. SED (cm)	Max. SED (cm)	Max. LED (cm)	Unit Value ($/m^3) Export Market	Unit Value ($/m^3) Domestic Market
Internodal Peelers	2.6	6.1	35	81	81	21.00	21.00
C & I Peelers	2.6	6.1	35	81	81	19.00	19.00
Domestic Sawlogs	3.8	6.1	23	-	-	10.00	10.00
Pulp	3.8	6.1	10	-	-	2.50	2.50
Export 12	12.1	12.1	15	-	-	40.00	Not Applicable
Export 8	8.1	8.1	15	-	-	40.00	Not Applicable

* *"Directional Felling Second Crop P. Radiata on Steep Country", Murphy G. & Gaskin J.E. LIRA Report Vol. 7 No. 1 1982.*

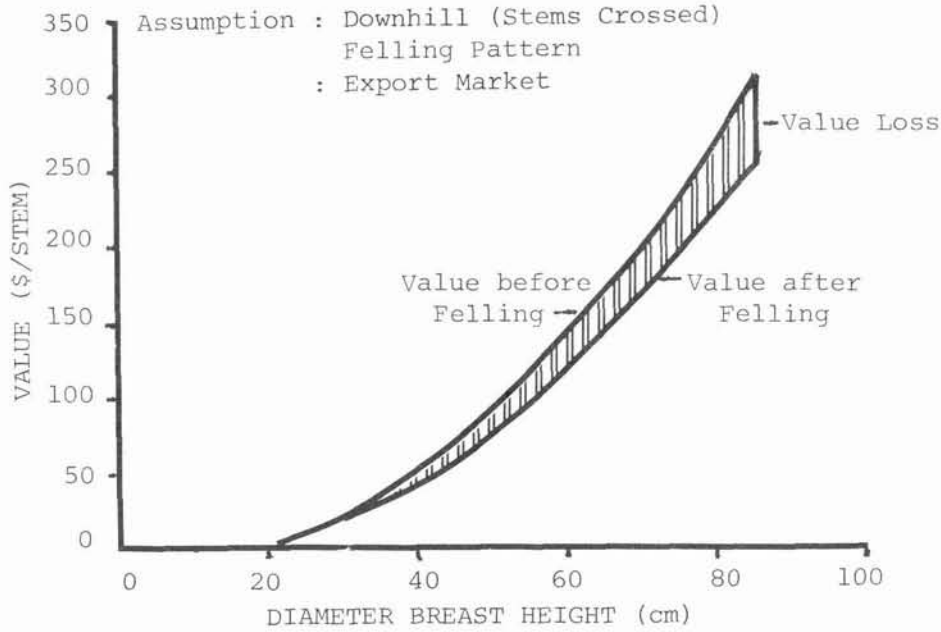
** *"A Method of Assessment of Recoverable Volume by Log Types", Deadman, M.W. and C.J. Goulding, NZ Journal of Forestry Science 9 (2) : 225-39 1979*

VALUE LOSSES

Four felling patterns were tested during the trial: downhill (stems crossed); downhill (stems parallel); across slope; and uphill 45°.

After the trees were felled, the breakage, butt damage, and stump height data were combined with the original MARVL field sheets and recoded. After processing these on a computer, new values for each tree were determined. Hypothetical value loss could then be calculated by subtraction. These losses were used to derive loss/diameter at breast height curves for each of the felling patterns. Figure I shows the relationship between value and diameter at breast height before and after felling for one felling pattern, downhill stems crossed.

FIGURE I: STEM VALUE



Because of minor site variations, the diameter distributions for the four felling blocks were similar but not identical. Tree size has a large affect on value losses. Therefore, to make a fair comparison of the felling patterns, pre-felling values or post-felling losses derived from the diameter related curves were applied to a standard diameter distribution. This distribution was the average from the four blocks felled.

FACTORS AFFECTING VALUE LOSSES

MARKET CONDITIONS

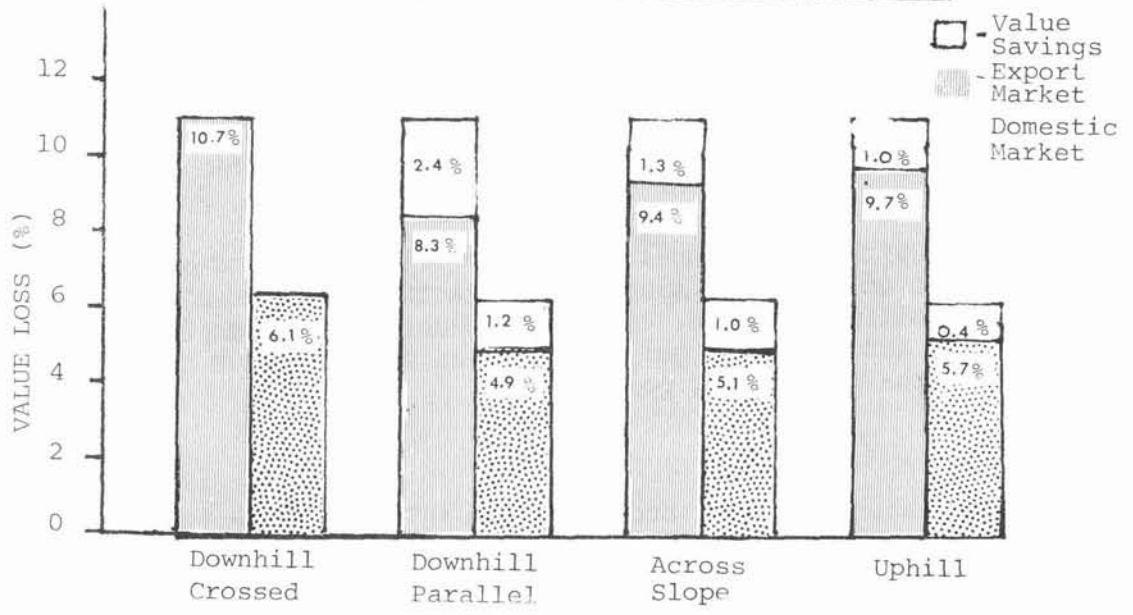
The magnitude of value losses was dependent on the market condition assumed. Losses were greater for the export market than the domestic, not only in terms of dollars due to greater export log values, but also in percentage terms because of the more rigid length specifications imposed on the export logs (ref.Figure 2).

FELLING PATTERNS

The current practice on steep country is to fell the trees downhill. The trend towards achieving greater felling production has resulted in trees being felled in a more haphazard pattern allowing the stems to cross. Crossing stems is one of the major causes of breakage. Of the four felling patterns tested, the downhill crossed pattern caused the greatest value losses: 10.7% and 6.1% for the export and domestic markets respectively. Value loss from the four felling patterns is shown in Figure 2, with downhill stems crossed serving as a base for comparison with the other felling patterns.

By felling the trees downhill, and taking care to keep the stems parallel, value loss was reduced by 2.4% (or about $770/ha) under the export market conditions, and 1.2% (or about $160/ha) under the domestic market conditions.

FIGURE 2 - VALUE LOSS FROM FOUR FELLING PATTERNS



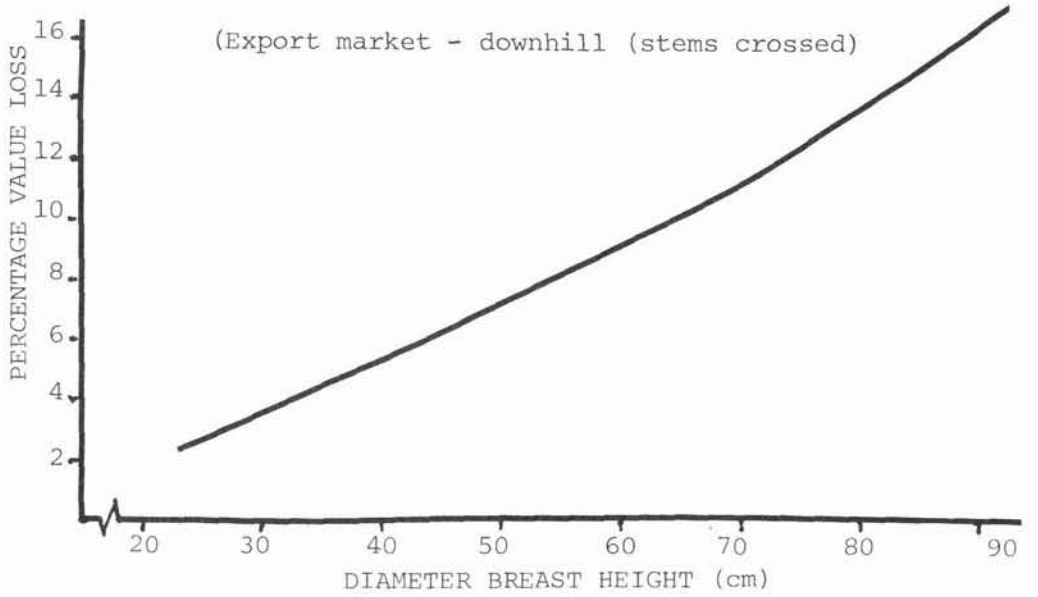
Value gained from felling trees across slope was less than for downhill (stems parallel). Only 1.3% ($420/ha) and 1.0% ($130/ha) could be achieved for the export and domestic markets respectively. Although breakage in the top part of the tree was reduced, some of this was offset by greater stump heights.

Value gained with uphill felling resulting from moving the first break higher up the tree and reducing the number of pieces above the first break were largely offset by the higher stumps and greater incidence of butt damage. The study mentioned in Reference I found that felling uphill was difficult and dangerous and generally should be avoided in mature radiata pine.

TREE SIZE

Considerably more value is lost when felling big trees than small trees. Not only are big trees worth more, but they are also more susceptible to breaking up during felling, thereby losing a greater percentage of their value. For example, about 4% of the value of a tree of 30 cm diameter is lost during downhill felling (stems crossed) whereas about 14% is lost when felling an 80 cm diameter tree.(Figure 3).

FIGURE 3 - VALUE LOSS VERSUS TREE DIAMETER



The reduction in average tree size, due to projected future shorter rotations, may reduce felling value losses. Because of the smaller tree size, value losses could be 1 to 2% less and value savings harder to achieve through adopting alternative felling patterns.

TOPOGRAPHY

Broken topography with short slopes will cause felling value losses about double those found on long even slopes other factors being equal. Under the export market conditions assumed, value loss doubled to around 20% when trees were felled across a deep gully. This was primarily due to a reduction in the height of the first break point.

STUMP HEIGHT

About 30% of the value loss that occurs during felling can be linked to loss of pruned log volume in the stump. For example, reducing the effective stump height (stump plus butt damage) from 0.5 to 0.1 m is roughly equivalent, in domestic market value terms, to moving the height of the first break up the tree by 5 metres. Small decreases in the effective stump height will save hundreds of dollars per hectare in value.

CONCLUSIONS

Value savings can be easily gained by keeping stump heights as low as possible and using felling techniques which reduce the incidence of butt-pull, side slabbing, and other forms of butt damage.

The current method of felling trees on steep country downhill, allowing stems to cross, generally results in the greatest value loss. Most of this loss occurs in the top half of the tree where impact energy is greatest. However in second crop tended stands, in comparison to old crop*, it has been calculated that changing the felling pattern can only lead to small value savings (up to 2%) because in this portion product values are low, log length specifications flexible and there are little or no export or domestic high value logs.

Felling downhill but ensuring the stems remain parallel would be the best pattern to adopt if value savings were the only reason for changing to an alternative felling pattern.

Value losses are much greater on broken topography, so wherever possible, felling across short gullies or sharp ridges should be avoided.

* *For information on value savings from cross slope felling in old crop stands refer "Directional Felling of Old Crop Radiata Pine on Steep Country", G. Murphy - N.Z. Journal of Forestry, Vol. 27 No. 1 Pages 67-76, 1982.*

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